WATER MANAGEMENT BRANCH
ENVIRONMENT AND RESOURCE DIVISION
MINISTRY OF ENVIRONMENT, LANDS AND PARKS

AMBIENT WATER QUALITY OBJECTIVES FOR HYDRAULIC CREEK OKANAGAN AREA

OVERVIEW REPORT

Prepared pursuant to Section 2(e) of the
Environment Management Act, 1981

Original signed by J. O'Riordan
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SUMMARY

This report assess the water quality of Hydraulic Creek near Kelowna BC. Due to an infestation of mountain pine beetle, tree harvesting in the Hydraulic Creek watershed has been occurring at an unprecedented rate to salvage timber while it is still marketable.

Much of the Hydraulic Creek watercourse is valuable habitat for wild and hatchery raised trout. Hydraulic Creek also serves as a source of drinking water for a population of 3500, and irrigation water for nearly 2000 hectares of agricultural land. The South East Kelowna Irrigation District (SEKID) is the purveyor for this water supply.

The Hydraulic Creek basin is primarily an upland watershed with very little anthropogenic activity other than that associated with timber harvesting. Therefore, the primary concern in the area is the broad-scale erosion of soil into the watercourse, associated with clearcut logging and road-construction activities. Provisional water quality objectives have been set for the protection of drinking water, irrigation and aquatic life. Water quality characteristics for which objectives are set include turbidity, suspended solids, temperature and microbiological indicators.

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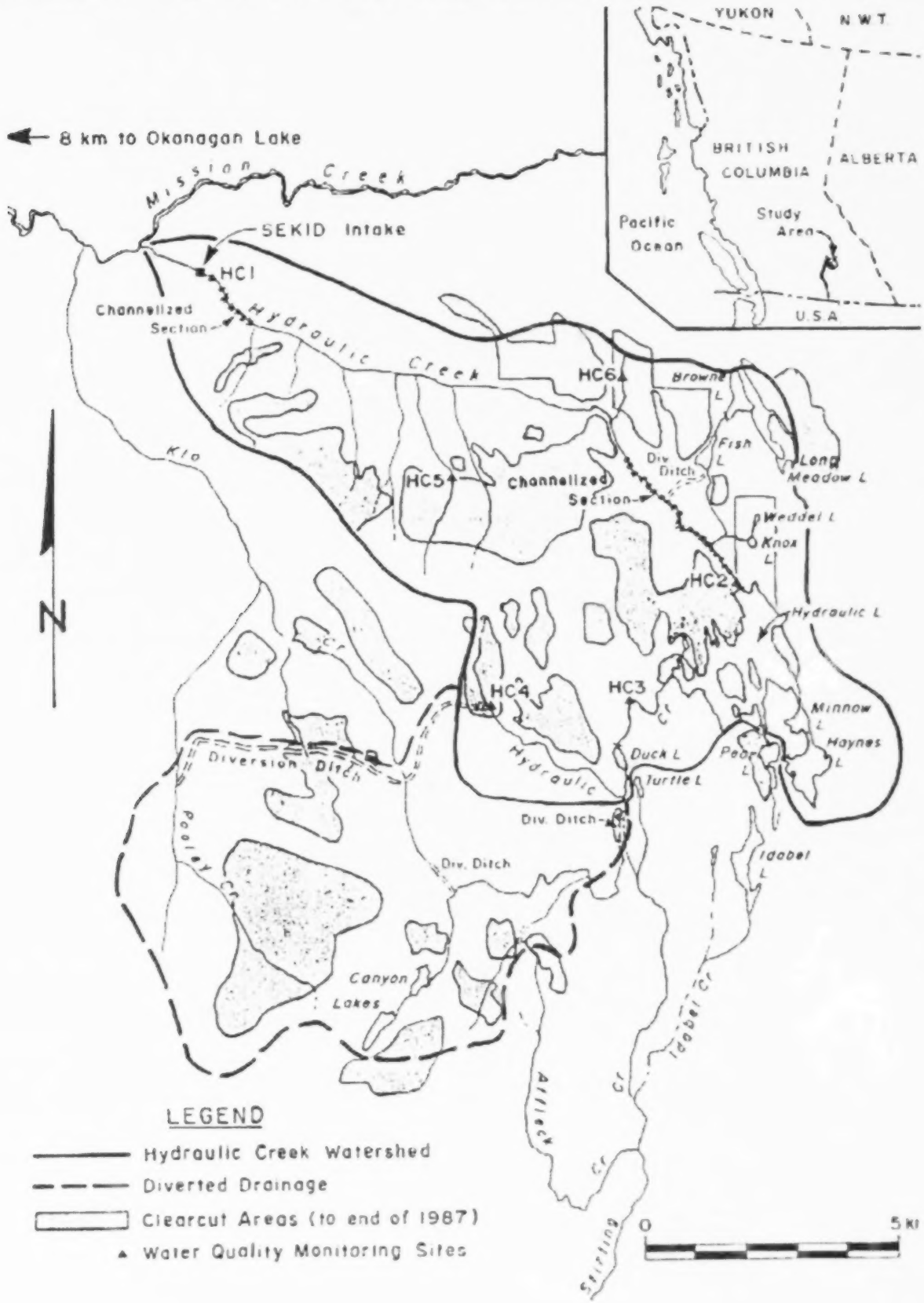
FIGURE

Figure 1. Location Map of Hydraulic Creek Watershed



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PREFACE

Purpose of Water Quality Objectives

Water quality objectives are prepared for specific bodies of fresh, estuarine and coastal marine surface waters of British Columbia as part of the Ministry of Environment, Lands and Parks' mandate to manage water quality. Objectives are prepared only for those waterbodies and water quality characteristics that may be affected by human activity now or in the near future.

How Objectives Are Determined

Water quality objectives are based the BC approved and working criteria as well as national water quality guidelines. Water quality criteria and guidelines are safe limits of the physical, chemical, or biological characteristics of water, biota (plant and animal life) or sediment which protect water use. Objectives are established in British Columbia for waterbodies on a site-specific basis. They are derived from the criteria by considering local water quality, water uses, water movement, waste discharges, and socio-economic factors.

Water quality objectives are set to protect the most sensitive designated water use at a specific location. A designated water use is one that is protected in a given location and is one of the following:

- raw drinking water, public water supply, and food processing
- aquatic life and wildlife
- agriculture (livestock watering and irrigation)
- recreation and aesthetics
- industrial water supplies.

Each objective for a location may be based on the protection of a different water use, depending on the uses that are most sensitive to the physical, chemical or biological characteristics affecting that waterbody.

How Objectives Are Used

Water quality objectives routinely provide policy direction for resource managers for the protection of water uses in specific waterbodies. Objectives guide the evaluation of water quality, the issuing of permits, licences and orders, and the management of fisheries and the province's land base. They also provide a reference against which the state of water quality in a particular waterbody can be checked, and help to determine whether basin-wide water quality studies should be initiated.

Water quality objectives are also a standard for assessing the Ministry's performance in protecting water uses. While water quality objectives have no legal standing and are not directly enforced, these objectives become legally enforceable when included as a requirement of a permit, licence, order, or regulation, such as the Forest Practices Code Act, Water Act regulations or Waste Management Act regulations.

Objectives and Monitoring

Water quality objectives are established to protect all uses which may take place in a waterbody. Monitoring (sometimes called sampling) is undertaken to determine if all the designated water uses are

being protected. The monitoring usually takes place at a critical time when a water quality specialist has determined that the water quality objectives may not be met. It is assumed that if all designated water uses are protected at the critical time, then they also will be protected at other times when the threat is less.

The monitoring usually takes place during a five week period, which allows the specialists to measure the worst, as well as the average condition in the water.

For some waterbodies, the monitoring period and frequency may vary, depending upon the nature of the problem, severity of threats to designated water uses, and the way the objectives are expressed (*i.e.*, mean value, maximum value).

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INTRODUCTION

This report summarizes the results of annual assessments on the effect of logging on the water quality of Hydraulic Creek and its headwater lakes. Receiving water quality objectives are proposed for those characteristics which may be altered by logging activities. These objectives are formulated to protect existing and anticipated water uses and are based on consideration of current water quality criteria and existing water quality and hydrology in the Hydraulic Creek watershed. A detailed technical appendix was prepared and forms the basis for the assessment, recommendations and objectives presented here.

Low intensity selective logging has occurred in the watershed over a long time-period. In 1984, in response to the mountain pine beetle infestation, the harvesting rate increased dramatically. Representatives of the South Easdt Kelowna Irrigation District (SEKID) have become increasingly concerned about the degradation of their water supply. In 1986, on request of the manager of SEKID, the Ministry of Forests and Lands (in consultation with representatives from the Ministry of Environment, Weyerhaeuser Canada Ltd., and SEKID) hired a consultant to provide annual assessment reports regarding the impact of logging on Hydraulic Creek water quality. The consultant concluded that water quality, especially turbidity and suspended solids concentrations, was being affected by logging. Given the importance of Hydraulic Creek for drinking water, irrigation water and recreational fisheries, the Ministry of Environment decided to establish water quality objectives for the protection of existing water uses in Hydraulic Creek.

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HYDROLOGY

Hydraulic CReek drains into Mission Creek about 10 km upstream from Okanagan Lake. Mission Creek empties into Okanagan Lake at Kelowna. Water flows in Hydraulic Creek are regulated in part by dams at the outlets of the major lakes in the system. The principal water storage reservoirs in the system include Hydraulic, Minnow and Haynes Lakes (McCulloch Reservoir) and Fish, Browne and Long Meadow Lakes (Figure 1. The creek flows into and out of Hydraulic Lake, which is the largest reservoir in the system.

During the period of high drawdown (June through September) for irrigation, the streamflow in Hydraulic Creek ranges between 1 and 1.5 m^3/s. During the remainder of the year, flows are commonly less than 0.1 m^3/s.

In 1982 and 1983, to improve water quality, sections of Hydraulic Creek downstream from Hydraulic Lake were channelized where the creek flowed through a swampy meadow.

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WATER USES AND PRETREATMENT FACILITIES

Hydraulic Creek serves as a source of drinking water and irrigation water. SEKID is the licenced purveyor for this water. The SEKID intake is located on Hydraulic Creek approximately 1.5 km upstream from the confluence with Mission Creek. Pretreatment facilities at the SEKID intake consist of 2 settling ponds and a balancing reservoir, rotating screens to remove large debris and chlorination at the point of entry into the pipeline.

Much of the Hydraulic Creek watercourse is important for recreational fisheries. Portions of the watercourse are used for spawning by rainbow trout and Hydraulic Lake is stocked with 12 to 15 thousand hatchery trout per year.

Thus the water quality should be suitable for drinking and irrigation needs at the SEKID intake and suitable for aquatic life throughout the entire Hydraulic Creek watershed.

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WASTE DISCHARGES (anthropogenic activities)

The Hydraulic Creek basin is primarily an upland watershed with very little anthropogenic activity other than that associated with timber harvesting. Thus the primary concern in the area is the broad-scale erosion of soil into the watercourse associated with clearcut logging and road-construction activities.

At the end of 1988, 3500 hectares or 27% of the total forested area of the watershed had been harvested. In January 1988 logging in the watershed was suspended pending a review of the situation by government agencies. Later in that same year logging was resumed in certain blocks.

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WATER QUALITY AND PROVISIONAL WATER QUALITY OBJECTIVES

http://wlapwww.gov.bc.ca/wat/wq/objectives/hydraulic/hydraulic.html

The logging activities in the Hydraulic Creek watershed apear to be having a detrimental effect on waterb quality in the system. While no prelogging water quality data were available, data collected during periods of low logging activity and from a control stream indicated that some water quality characteristics have increased considerably during periods of accelerated harvesting. The characteristics most affected include turbidity and suspended solids. For other water quality characteristics, such as colour, water temperature and phosphorus, although variations in the data were noted it was not clear whether the changes were due to logging or to natural causes.

Provisional water quality objectives were set for those water quality characteristics that exceeded or were near criteria levels for designated water uses (drinking water, irrigation water and recreational fisheries), and that may be affected by logging activities. They include turbidity, suspended solids, microbiological indicators and water temperature. Although water colour was very high in the Hydraulic Creek system, it appeared to originate from natural sources and not from logging activities. Therefore, a water quality objedtive for colour was not recommended. A summary of the recommended water quality objectives is presented in Table 1 at the end of this report.

Water quality objectives have no legal standing would not be directly enforced. The objectives can be considered as policy guidelines for resource managers to protect water uses in specified water bodies. They will guide the evaluation of water quality, the issuing of permits, licences and orders and the management of the fisheries and of the Province's land base. They will also provide a reference against which the state of water quality in a particular water body can be checked, and serve to make decisions on whether to initiate basin-wide water quality studies.

Depending on the circumstances, water quality objectives may already be met in a water body, or may describe water quality conditions which can be met in the future. To limit the scope of the work. objectives are only being prepared for waterbodies and for water quality characteristics which may be affected by man's activity, now and in the future.

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MONITORING RECOMMENDATIONS

Water quality monitoring in Hydraulic Creek has been performed on an approximately weekly frequency, from mid-March or April through to about mid-October, for the past three years (1986, 1987 and 1988). Weekly monitoring should continue each year over these same months to ensure that water quality objectives are being met.

Water quality characteristics that should be measured on a weekly basis at four established sites (HC1 to HC4) include turbidity, suspended solids and water temperature. In addition, microbiological indicators should be measured at HC1 on a weekly basis throughout the monitoring period. Nitrite alone and chloride should be checked twice during one monitoring season at each of the four sites (HC1 to HC4) to confirm that the appropriate criterion for aquatic life (Table 3) is not being exceeded.

An additional monitoring site in Hydraulic Lake should be included to keep track of nutrient enrichment. Since residence time of the epilimnetic water in Hydraulic Lake is estimated to be less than 6 months, we recommend that total and dissolved phosphorus in Hydraulic Lake should be measured at least monthly during the growing season (from May to September). In addition, total and dissolved phosphorus should also be measured simultaneously at the lake outlet (site HC2) for one growing season to determine if this site would serve as an adequate substitute for the lake site in future years. If the

mean epilimnetic phosphorus concentrations at the two sites do not differ significantly at the 95% confidence level, then the lake site could be abandonded in favour of site HC2.

A summary of the recommended monitoring is shown in Table 2 at the end of this report.

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TABLES

Table 1. Provisional Water Quality Objectives for Hydraulic Creek

sample sites	HC1	HC2	HC3	HC4
designated water uses	drinking, irrigation, aquatic life		aquatic life	
turbidity	5 NTU maximum		10 NTU maximum	
suspended solids	20 mg/L max	not applicable	20 mg/L max	not applicable
temperature	18 degrees Celcius maximum			
enterococci	3/100mL	not applicable		
fecal coliforms *Escherichia coli*	10/100mL	not applicable		

1. The microbiological indicators, enterococci, fecal coloforms and Escherichia coli, should not be exceeded in at least 90% of the raw water samples taken in a 30-day period.
2. The SEKID intake is for the South East Kelowna Irrigation District.
3. HC1, SEKID intake; HC2, outlet of Hydraulic Lake; HC3, upstream from Hydraulic Lake; HC4, headwaters of Hydraulic Creek

Table 2. Recommended Routine Water Quality Monitoring for Hydraulic Creek and Lake

Sites	Frequency and Timing	Characteristics
HC1	weekly from April 1 to October 15	microbiological indicators
HC1, HC2 HC3, HC4	weekly from April 1 to October 15	turbidity, suspended solids, temperature
	twice during 1 monitoring season only April 1 to October 15	nitrite and chloride
Hydraulic Lake mid-lake site	once monthly during the growing season May through September	total and dissolved phosphorus

Note: Sampling may need to be increased to check objectives, depending on circumstances.
1. Hydraulic Lake should be sampled in the epilimnion and both HC2 and the lake site should be sampled simultaneously or as close as is reasonably possible.
2. HC1, SEKID intake; HC2, outlet of Hydraulic Lake; HC3, upstream from Hydraulic Lake; HC4, headwaters of Hydraulic Creek
3. The SEKID intake is for the South East Kelowna Irrigation District.

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